PARTIAL REPORT OF SURVEY OF THE WESTERN DIVISION, INCLUDING SKETCHES OF PULASKI AND WHITE COUNTIES.

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The work of examining the counties included in the Western Division, as indicated by the Chief of the Department, has been prosecuted as the fund at hand permitted. It is not yet finished, and it would be premature to make at this time anything like an extended report. The discovery of natural gas in the State necessarily changed the plans of the Department and turned its attention to a search for that valuable deposit, hence a large area of country which had already been surveyed by former State Geologists had to be gone over again in order to locate approximately the surface under which gas discoveries might be expected. This stopped the work which was going on in and near the Kankakee Valley and turned the attention of the assistants in the field to an area further south and east. My own work and observations, therefore, have been largely directed to the question of natural gas developments, and consequently much less than I hoped to do has been accomplished in other directions.

At present the area in Indiana under which the supply of gas is of paying value, may be said to lie within a well-defined circumference, and it is not to be expected that any great discoveries remain to be made in this connection. The State Geologist has refrained from discouraging the sinking of wells, even where it was not thought that they would be successful, for it was desirable that the popular feeling for investigation should take its course and fully exhaust itself, in view of possible discoveries. The result has been the piercing of the stratified rocks in the immediate neighborhood of almost every town in the State. The gas field has been pretty thoroughly explored, and incidentally we have obtained a most interesting and instructive view of the strata down to the horizon of the Trenton limestone. Meantime, however, the work of collecting facts relative to other features of the State's geological formation has been

progressing as fast as circumstances would permit. Possibly, even probably, those things which form the smallest part of a report made for popular reading, information and instruction are those which convey the gist of what scientists would care most to know, and indeed, outside of the discovery of natural gas and the tremendous impulse it has given to the manufacturing interests of our State, there is nothing of a sensational nature, in our geological observations, to either scientist or unlearned citizen. Still the work must prove of great value to the people, not so much as a record which will immediately chain their attention, but more as a widely disseminated and authoritative advertisement of the mighty resources of our great commonwealth.

The chief question of interest to the scientific world, and which will be reported upon so soon as the survey of the western division shall be completed, is connected with the great moraine of the northern part of the State, and with the ancient shore-line of Lake Michigan. Much work has already been done in the way of preliminary expeditions and explorations for the purpose of securing an outline of the chief features and of the general contour of the areas to be studied. This work can not be included in this report, because it is not yet sufficiently advanced to render the step advisable or profitable, as a report now would necessitate a reiteration of its facts in the next volume at great expense, and without any corresponding value to the people. It has, therefore, been thought advisable to defer an extended report upon the western division until the work has been measurably completed.

The particular counties, surveys of which will affect the study of the ancient shore lines of Lake Michigan, the area drained by the Kankakee River, and the northermost morainic formations in the northwestern part of the State, are: Jasper, Pulaski, Fulton, Marshall, Starke, St. Joseph, Elkhart, Laporte, Porter and Lake. Through the region occupied by these counties the Kankakee River flows in a general direction somewhat southeasterly, and the stream is bordered by wide marshes and wet prairies, which makes it quite difficult to survey. It is, however, the most interesting region in the State, and one which offers great returns for intelligent observation and labor. The well known "swamp lands" of the Kankakee must some day be drained, and it would appear to be the duty of the State to have a proper survey made with a view to ascertaining the most practicable and the cheapest plan for doing this. It would be much easier and cheaper to make this survey in connection with the geological examination now progressing than it ever can be hereafter. At a comparatively small additional expense the State Geologist could direct both surveys at once, and at the same time make each a great help to the other. This would not only outline all the deposits accurately and locate them distinctly, but it would give levels and indicate lines of drainage of immense value to all the people in the counties adjacent. It is quite

plain to one having a knowledge of engineering that a large part, if not the whole, of the area now lying useless, thousands upon thousands of acres, might be reclaimed easily and at comparatively small expense, if the proper lines of drainage were first located. It is not a pleasing commentary upon the enterprise and forethought of our State that in one of its fairest and, potentially, most fertile areas there lies a vast waste, given over to the frog, the snipe and the heron, the lily-pads, the water grasses and the stagnant pools, when energy and the intelligent application of well known methods would make it almost a garden spot. On the other side of the Kankakee valley, after leaving the marshes, we find excellent grazing and farming lands. Indeed, much of the swamp land is used for meadow and for stock grazing in the dry seasons. In many places the lowering of the water level a foot or two would reclaim many hundreds of acres, making most excellent pasture lands.

Contrary to what might be expected of a region so marshy and interspersed with stagnant ponds and lagoons, the whole Kankakee region is a healthful one. There is less malaria in the midst of this vast swampy waste than there is in some of the most thickly settled parts of the State. This favorable condition may be due to the iron in the water and to the strong and almost constant wind currents which in summer and autumn sweep over the region from the lakes on the north and from the high prairies on the west. Be this as it may, the Kankakee River has long been a summer resort for those seeking health and out-door recreation. Excellent boating, fishing and shooting add charm to the solitude and salubriousness of the region. The river itself, though not a large one, is beautiful, winding through its marshes, its groves and its giant grasses and among its wooded islands. Here and there it spreads its channel and becomes a lovely, lily-fringed lake. Its bed is in the blue bowlder clay from its source to near Momence, where the stratified rocks appear at the surface forming a great dam across the course of the stream. North of the river I have not found, as yet, any outcropping of paleozoic strata. Many deposits of bog iron ore and a few chalky formations are the only mineral features promising commercial value. I think it quite probable that there may be discovered large quantities of clay of a quality suited to coarse pottery manufacture.

It will be a very tedious process by which the work of the survey must be done in all this region. Much of the surface is almost impassible save in the dryest season, and even then its nature is such that the progress of examination is necessarily very slow. The whole area is rich in botanical interest, and the final report upon it will, it is hoped, have its value as a contribution to the study of our middle western flora. So far the notes of the region point to some exceedingly curious and interesting discoveries touching the migration and the nesting habits of aquatic and semi-aquatic birds, a subject at present engaging the attention of scientists everywhere,

But, to my mind, the chief value of the survey to the people of the area to be examined will be its bearing upon the question of the drainage and reclamation of the wet lands. Certainly this is a matter of largest importance to a great number of our citizens, and it should be a subject of earnest consideration in the minds of our legislators. If, in connection with the survey there could be a set of levels taken by which the valley of the river and the contour of its surface could be outlined, we should have the best possible basis (at the least possible cost) for any future draining operations. A line drawn through Laporte, Valparaiso and Crown Point would roughly indicate the northern limit of the Kankakee valley, while on the south the boundary line lies irregularly from six to twenty miles distant from the stream. This may be justly named the youngest valley in the State, as its formation is wholly post-glacial. It may, however, simply mark the approximate line of a very ancient stream. As I have said, its entire depression is in the drift matter, the bottom of the river channel being often from one to three hundred feet above the surface of the stratified rock. The wells bored in the region indicate that during the glacial period a lobe of the great glacier followed the course of the northern side of a ridge (or upheaval which had occurred at about the close of the Niagara period), and left upon its withdrawal a deep irregular deposit of till or bowlder clay filling the ancient channel. On either side of the river, at unequal distances, the stratified rocks when reached in wells show the effect of erosive agencies having a tremendous power. Moreover, the sudden alternations of geological horizons indicate that superior strata have been non-conformably deposited upon the Niagara rock, which is greatly disturbed and displaced by faults, conical uplifts and short, steep monoclines.

As the State Geologist himself has observed in another paper, the wells bored near Francisville plainly show these conditions and what is true of that special area is more or less true of a very large region so far as we have data on the subject. It would appear probable, that when all the facts shall have been collected and digested we shall find that the Niagara upheaval across Indiana is part of a great continental lift which has served to divide the two great coal basins, (that of Michigan and that of Indiana) from each other, and that on either side of it the strata superior to the Niagara will be found to rest nonconformably against the inclines of that broad gentle upheaval. This of course is speaking generally; the details, if traceable, would show every shade of departure from the strict general rule. The apex of the great divide has been ground off by glacial action and many curious outlines have been left, notably the sandstone deposit near Rensselaer, which has every appearance of having been transported bodily to its present situation by some agency of incalculable force and of a peculiar nature. Evidently this sandstone is not in place; all its surroundings clearly show this. It lies on the highest part

of the region in which it is found, it is true, and has under it an older formation, but the rock immediately below it is not the proper geological substratum of this sandstone, it appears; it is the corniferous limestone of the Devonian age, and is cut and channeled by the glaciers. Professor Collett reports the surface of this sandstone as showing the striæ and planing action of ice. This could be and would be true even if the whole had been transported to its present site by glacial action. The frequent withdrawals and returns of the ice during the glacial period had the effect of so many glaciers. At another place I have described this very interesting and curious feature. Quite different from this are the deposits of Devonian black shale and Corniferous limestone found in the lower areas of this region with cones and ridges of the Niagara rock lifted up between. A little farther south than the limit proper of the Kankakee Valley the subcarboniferous rocks are found here and there laid down conformably on the Devonian black shale.

One of the marked features of the whole northeastern area of the State is the varied and picturesque deposit of sand. This is a fine silicious body, of a pale buff color, which in the vicinity of the shores of Lake Michigan takes on the form of shifting cones and ridges. The ancient shore line, or rather lines, each of which probably marks a former limit of the lake's waters, have not yet been traced and outlined sufficiently to be reported here; but evidence is in hand which will probably show that that there has been from two to four, and possibly five, distinct, well-marked recessions of the water since Lake Michigan took substantially its present form. The examinations have not been full enough to justify an opinion, even of a provisional sort, as to whether these retrogressive movements have been sudden and cataclysmic, so to speak, or whether they have been slow and gradual. The general shape of the lake appears to have been much the same at its southern extremity during all the vicissitudes of its past history, as the ancient shore lines are practically parallel with the present one.

Coming to speak more particularly of the immediate channel of the Kankakee River, the first thing to be noted is the frequency of the changes which have taken place in its course and locus at various places. The fall is slight throughout the river's length in Indiana, and the sluggish current has frequently filled its channel with silt and sought a new course by washing out another, and often by a more roundabout way. Some of these old channels are still observable in the marshes, where they appear as long, shallow, stagnant lagoons filled with aquatic plants, the haunts of large wild fowl and various species of the smaller game birds. The present course of the stream is very crooked, in places almost doubling on itself, and to this fact may be referred, in a large degree, the wide overflows which occur in certain localities during the spring and autumn freshets. The water of the river, especially when low, is perceptibly af-

fected by the presence of salts of iron, the oxide of which colors it a pale ochreous yellow. Most of this iron is from springs and slough-streams that rise through ferruginous deposits.

The immediate banks are usually very low and covered with a dense growth of plants of various kinds, chiefly trees, weeds and grasses, but, as might be expected, the soil is mostly a light sandy alluvium with a large per cent. of vegetable matter. This soil, when drained, would at first be too porous, but it would gradually become more and more compact and fertile as the process of oxidation and chemical change went on, a process which could be materially assisted by the addition of lime. I do not hesitate to say that a large part of what is now the most worthless part of these Kankakee marshes would become, under a properly directed system of drainage, one of the richest areas in Indiana. Every element of fertility is present in exhaustless supply, and nothing save the superabundance of water keeps it in its present state of desert and uninhabited wildness. By straightening the course of the river and constructing a few ample cross drains the whole valley would be turned into a rich and desirable farming region. As to the cost of such a work, I have no basis for an accurate estimate, but a long experience in engineering teaches me that it would be far below the value of the benefits that would accrue to the lands. Indeed, there is not now anywhere in the country an enterprise which would bring a better return for intelligent management and judicious expenditure of labor and money. It is a work that must and will be done, and the sooner the better for the reputation as well as for the happiness and general welfare of the people.

It is preposterous to suppose that in the heart of Indiana an area of rich and valuable lands almost as large as the State of New Jersey is to be left much longer in an utterly waste and desolate condition when a little enterprise would make it one of the fairest parts of the State. Even should the undertaking finally cost more than the actual enhancement of the value of the real estate, it would be commendable for the State to remove the stigma attaching to her reputation on account of such a blot upon the face of her domain.

The botany and zoölogy of the Kankakee region will prove of great interest when it shall have been fully studied and arranged. A great mass of notes has been collected already; enough to show how rich will be the returns for labor expended in this direction, and of what value to science and general education the careful study of even limited areas of undisturbed nature may be made by placing the results in a form readily accessible to all who may be interested.

At various points in the Kankakee region persons have reported the discovery of coal, but there is no coal. The black shale of the Devonian formation is often quite bituminous, and will then burn with a clear flame not unlike that of cannel coal. Fragments of this rich black shale have

been found in the drift, hence the mistake. Coal can not be found here. The beds of iron ore are of excellent quality, being massive deposits of gray-brown bog concretions. The time may come when these will be of immense value.

The following pages contain a general sketch of the geology of White and Pulaski Counties and a few notes on the Tippecanoe River, but by far the greater part of the field notes made in this region have been retained for a future report or have been used by the State Geologist in other papers contained in this volume. It will require at least two more years to get together all the facts for a full report of the Kankakee and the region which should be drained by it.

WHITE COUNTY.

This is one of the new counties of Indiana which, by virtue of its fertile soil, excellent location, and the energy and intelligence of its inhabitants, is being rapidly developed into one of the most prosperous divisions of the State. It is bounded on the north by Jasper and Pulaski counties, on the east by Cass and Carroll, and on the south by Carroll and Tippecanoe, and on the west by Jasper and Benton counties. The general surface of the ground is very level, and though drained by a large number of streams the soil is too wet for successful cultivation without a large amount of artificial drainage. The basis for a thorough system of drainage is supplied in the large number of natural streams by which the surface of the county is channeled in almost every direction. Chief of these streams is the Tippecanoe River, which enters the county from the north, flows in a southwesterly direction for eight miles to the south line of Liberty township, thence a little east of south to the town of Monticello, and thence almost due south along the eastern line of the county to the north line of Tippecanoe County.

This river has carved for itself through the county a wide and deep valley, and into it all the other streams of the county empty themselves.

The Big Monon Creek enters the county from the north at a point six miles west of the Tippecanoe River, and flowing thence south for four miles to its confluence with the Little Monon Creek, then runs to the southeast and in a course of two miles falls into the Tippecanoe.

The Little Monon Creek, above referred to, rises in Benton County and flows for fifteen miles in a generally northeasterly direction through White County to the town of Monon, whence it runs east and then southeast to its junction with the Big Monon Creek.

Honey Creek rises in West Point Township, within a mile of the Little Monon, and flowing thence northeast for three miles almost parallel with the Little Monon, turns due east and runs into the Tippecanoe River three miles below the mouth of the Big Monon.

Big Creek rises near the west line of the county, only a short distance south of the head waters of the Little Monon, flows east through West Point Township, and two miles into Big Creek Township, thence by a long, sweeping curve through a course north, northeast, southeast and south, it empties into the Tippecanoe River.

Indian Creek runs west along the north line of the county to its junction with the Tippecanoe, and other streams flowing from the east empty into the river above the Norway Mills.

In the south several streams carry the surface water from Prairie Township into the river. Few counties in the State are so well supplied with flowing water, and few level and humid sections of the country are so well furnished with natural drains.

These streams are generally bedded in the drift deposit which covers the whole of White County, though in the northwestern part of the county the Little Monon Creek, and some others of the small streams run over a floor of the Niagara limestone, and at a few points, from Flowerville south, the Tippecanoe River cuts through the drift and exposes the Devonian shale. All these streams lie sufficiently below the general surface of the surrounding country to give abundant fall to such lateral ditches as shall be constructed in any proper system of drainage, and capital and energy only are required to render the lands of this county fruitful to a degree scarcely to be measured.

HISTORY.

This county formed a part of the ancient domain of the Pottawattomie Indians, though the Miamis claimed the land by right of temporary occupancy. The former nation was, however, in possession when the whites began to explore the country, and it was with the Pottawatomies that the General Government treated, when on the 2d day of October 1818 that tribe ceded to the United States all that tract of country situated within the bounds following: "Beginning at the mouth of the Tippecanoe River and running up the same to a point twenty-five miles in a direct line from the Wabash River, thence on a line as nearly parallel to the general course of the Wabash River as practicable to a point on the Vermillion River twenty-five miles from the Wabash River, thence down the Vermillion River to its mouth, and thence up the Wabash River to the place of beginning." This included the greater part of what is now White County. The remainder of the territory now contained within the limits of the county was added by the terms of a second treaty executed on the 16th day of October 1826. By that treaty the Pottawatomies ceded the lands bounded as follows:

"Beginning on the Tippecanoe River where the northern boundary of the tract ceded by the Pottawatomies to the United States at the treaty

of St. Mary's in the year 1818 intersects the same, thence in a direct line to a point on Eel River half way between the mouth of said river and Parish's Village, thence up Eel River to Seek's Village (now in Whitley County) near the head thereof, thence in a direct line to the mouth of a creek emptying into the St. Joseph's of the Miami (Maumee) near Metea's Village, thence up the St. Joseph's to the boundary line between the Ohio and Indiana, thence south to the Miami (Maumee), thence up the same to the reservation at Fort Wayne, thence with the lines of the said reservation to the boundary established by the treaty with the Miamis in 1818, thence with the said line to the Wabash River, thence with the same river to the mouth of the Tippecanoe River, and thence with the Tippecanoe River to the place of beginning."

It was several years after these treaties before the Indians were removed to the Indian Territory, and the lands of the county were not opened for entry until in November 1829, and many sections were not opened for entry until 1839.

No sooner were the entry books opened than the pioneers began flocking in, and as early as 1833 the Legislature was asked to have a new county located and organized, and on February 1st 1834 the act constituting and defining the limits of White County was approved. The name assumed was in honor of Major Isaac White who was killed in the battle of Tippecanoe. The large section of country now comprising the counties of Jasper, Newton, and portions of Benton and Pulaski, by legislative enactment remained attached to White County and it was only by the constitution of Benton County in 1840 that the County of White was circumscribed by its present boundaries.

Like most of the northern counties of Indiana its march toward settlement, cultivation and prosperity has been very rapid. In September, 1834, the county seat was established by three commissioners, John Kilgore, John B. King and James H. Stewart, on the west bank of the Tippecanoe River, and named the place Monticello, as they declared "after the home of the great disciple of human liberty, Thomas Jefferson."

The lands of the county are generally level, but greatly diversified in appearance, portions being prairie, other portions oak-openings, while some tracts are heavily timbered. The soil is mostly a heavy black muck or mold, requiring drainage to render it fit for cultivation, though across the north side of the county may be seen in many places those singular ridges of fine yellow sand, which in ever increasing size and number dot the prairie northward to Lake Michigan. These ridges of sand are generally thickly covered with a forest of small oaks, and greatly enhance the beauty of the landscape when summer has cloaked them with her heavy green mantle.

A difference of opinion exists as to the origin of these sand hills, but the better argument is in favor of the transporting agency of the winds.

It seems probable from the surface evidence that Lake Michigan once extended very much farther in a southeasterly direction than it now does, but whether this be true or not, the fine lake sand which forms these long parallel ridges evidently owes its separation from the bowlder drift to the restless waves of that great lake. The process of expulsion from the lake may be seen now constantly going on at Michigan City. The prevailing winds from the northwest roll the sand-bearing waves ashore; the sand is deposited as the wave halts and recedes, and the wind, catching the fine grains of sand, whisks them up and over the shore hills and away across the level lands of the interior. In time of a strong and equal blowing wind a delicate veil of sand may be seen floating like a gauze streamer from the top of any exposed sand hill on the southeast shore of the lake.

It is true that the lake sands are not now rolled so far inland as we find the ancient deposits, but it should be remembered that the conditions are now different. For ages after the deposit of the cold bowlder drift and the retreat of the great ice cap there was neither vegetation nor other obstruction to the free rush of the winds. And how they must have played over this great floor! The shallow waters of the lake extending far into the interior of Indiana were stirred to the bottom. The fine sand was lifted like dust and tumbled into ridges. Shore line after shore line marks the recession of the water, and between these shore lines the sand dunes lie where the waves of the wind have heaped them. Below these sands the glacial drift overlies the rock throughout the whole of White County in varying depth, from a mere film at Monon to a depth of nearly three hundred feet in the northeastern portions of the county. The power of the ice during the glacial period to plane down the inequalities of the earth's surface, no matter how refractory might be the material obstructing its flow, is well exemplified by a late exposure of the Niagara rocks near the town of Monon. At a point about a half mile southeast of the town the Indianapolis division of the Monon Railway (the Air Line) crosses the Little Monon Creek on a low trestle, and in approaching the creek from the south side ditches have been cut almost down to the surface of the rock. Late floods of rain have washed out these ditches near the mouth to such an extent that a floor of the limestone has been laid bare thirty feet in length by ten feet wide. This floor is planed smooth as glass save for the striæ marking the surface from north to south, indicating the direction of the ice flow.

How much of the top of the broad cap of Niagara limestone which rises almost to the surface of the ground in the western part of this county has been planed off, ground to powder and mixed with the bowlder drift can not be known, but the resistless force of the moving ice cap is perfectly attested.

So great is the mass of bowlder drift in the northeastern portions of the county that but little can be learned as to the character and condition of the surface rocks. The few bores that have reached the stratified rocks in that section have found the Devonian shale, and as the same rocks were found at Monticello and outcrop both above and below that place in the bed of the Tippecanoe River, there is little doubt that rocks of the Devonian period underlie the glacial drift over nearly the whole of the northeastern half of the county. Across the southwestern angle of the county the stratified rocks below those of the Devonian period have been upheaved. By this upheaval the Niagara rocks, which at that time were the surface rocks, were wonderfully shattered and the fragments tilted in many different directions. The crown of the upheaval in this section lies in the vicinity of the town of Monon, extending from a point one mile south of the railway crossing to a point two miles north of Francisville, in Pulaski County, and thence in an irregular line to the west to a point northwest of the town of Rensselaer, in Jasper County. The summit of this crown was pierced by the old well on the "Blair farm," and there the limestone was overlaid with only a shallow cloak of drift, a half dozen feet in thickness. Indeed, at several points on this farm the Niagara limestone appears above the soil.

After the upheaval of the older *strata* of the sedimentary rocks the various strata of the Devonian rocks were deposited, and wherever found in place the lowest *stratum* of the later period may be found so embedded upon and against the up-tilted and broken rocks of the older deposit as to furnish indubitable proof of the ancient disturbance of the lower stratifications.

The advance of the great glacial plane found this elevation of the lower rocks an obstruction in its path, and with a power irresistible, and indeed unimaginable, shoved off the crown of the arch, paying as little heed to the refractory limestone as to the friable shale. The exposed limestone in the bed and banks of the Little Monon Creek at the crossing of the Louisville, New Albany & Chicago Railway, a quarter of a mile south of the town of Monon, and which extends down the course of the creek for a mile to the east, is massive in formation, of excellent quality for the lime-burner's use, and is easily quarried, as the thin overlying drift is but little hindrance to immediate blasting.

For many years this stone has been burned into lime at the railway crossing, and an excellent lime has been produced, of much the same character as the well known Delphi lime. This rock is unusually full of fossils, and holding so much oil as to greatly aid in the process of burning. The rock is quarried in the bed of the stream and is freed by the bar without blasting, coming away in flakes and triangular blocks, the crevices filled with a heavy oil by which the rock is much discolored. Little attempt has been made to utilize this limestone for building purposes, and

not much can be said in its favor in that behalf. For foundations, culverts, and for abutments for bridges and backing for range masonry it could be safely and effectively used, but it is not to be recommended for walls requiring faced stone. Indeed the difficulty of properly dressing the stone to uniform thickness, coupled with the shattered condition of the upper strata, render it unavailable for good range work. It would be interesting to know just what the surface conditions of the earth at this point were at the time of the great north and south ice flow, which crawled across this region pushing its mighty plane before it, and by virtue of its enormous weight shearing away the obdurate limestone with the same ease with which it leveled the domes of sand.

It is not possible for us to now determine just how much of the upper Silurian rocks has been thus removed, nor can we say with any approach to certainty to what depth the rocks of the Devonian period were originally deposited at this point. The evidence now obtainable points to a solution more curious than valuable, and one which may be greatly modified by a careful examination of the regions lying farther north. It appears that at the end of the period in which the Niagara rocks were deposited there was, in this region, an upheaval which lifted the then surface rocks to a point somewhat higher than at present found, the crown of the arch along the axis of upheaval passing through White County from northwest to southeast, the highest point being near the present town of Monon.

The Devonian seas, deeper to the southwest and to the northeast, scarcely over-topped this ridge of Silurian rock, and the sedimentary deposit of the Devonian age but lightly covered the Niagara rocks. Whether the seas of the carboniferous period reached so far north and east, or rose to such a height as to cover this ridge with any deposit of even the lowest subcarboniferous stratum, can not now be more than guessed at, for if any such evidence ever existed the ice flow has removed every vestige of it, sparing only occasional patches of the Devonian rocks, and at certain places cutting away many square miles of the upper Silurian rocks. Along the banks of the Little Monon, wherever the surface rocks are exposed, the action of the ice may be observed. At the crossing of the Air Line Railway over the stream, a half mile southeast of the junction of that railway with the Louisville, New Albany & Chicago Railway, the action of the surface water discharged by the railway ditches has denuded the rock for a distance of thirty feet, exhibiting the planished and striated surface precisely as it appeared when the ice retired from it. The *striæ*, beautifully and clearly drawn in unbroken parallels across the whole of the exposed table, bear witness to the persistence as well as power of the leveling force. An iceberg afloat could not by mere impact, however great its weight or powerful the winds or waves by which it was moved, cut away great crowns of obdurate rock, nor groove the wide table with

the long parallels of *striæ* as they here appear. Nothing but the advance of the continental ice field could have effected such a work. Moving down with all the resistless force of a growing rock, the enormous ice cap was no more retarded by the most compact limestone than by the softest shale, and taking off the crown of this Silurian uplift, left the superficially lower lying Devonian to the north still in place.

A few miles west of Monon, but in the County of Jasper, the curious feature appears of an out-crop of the massive conglomerate sandstone of the carboniferous age. At what is known as Pierce's quarry, now operated by Mr. James F. Watson, of Rensselaer, this sandstone covers with a cap several feet in thickness a slight swell in the prairie of perhaps thirty acres in extent This stone is not found otherwhere in this region, and appears to be lying far below its true horizon. So little reason is there for its anomalous situation that I carefully examined the field to see if I could discover any evidence of its having been transported in a body by the ice from the north. No such evidence was presented, except, perhaps, the peculiar position of the strata, and this may be as well accounted for in other ways.

This sandstone cap *seems* to be in place, and doubtless is, and the geologist must needs account for its present position by supposing that at one time the ancient carboniferous seas extended at least an arm as far north and east as this locality, and here deposited upon a continental or island shore line the massive conglomerate sandstone where it is now found. Many theories might be advanced, each with some show of support, to explain the manner in which this isolated remnant of the ancient deposits was excepted from the wholesale erosion which removed all other traces of the carboniferous rocks, but it is enough to say that from *some* cause the sullen wrath of the boreal invader spared this little hill-cap as a monument to inform us of the utmost reach of these carboniferous seas.

A careful examination of the quarry revealed a complicated structure of this hill-cap. The opening of the quarry was originally begun near the southern edge of the deposit as it yet exists, and the advancement of the work of removing the stone has been in a direction almost due north for several hundred feet This has enabled us to trace the dip of the strata through all that distance. For nearly the whole distance the dip of the strata is heavily to the southwest. However, at the northernmost point now reached, and which is also the highest point of the deposit, the dip ceases and the strata lie horizontally. The rock is greatly broken up, the crevices extending perpendicularly through all the strata yet exposed, and dividing the stone into cubes, parallelograms, and triangular blocks of such shape and size as to be quarried with much less labor than would otherwise be required.

The quality of this stone is excellent, as may easily be proved by many examples in the neighborhood. The foundations of some of the largest public buildings in Rensselaer came from this quarry, and no stone could better serve that purpose.

The grain of the stone is even and fine, and the clean white color indicates the almost total absence of the iron which is so generally found discoloring the sandstones of the carboniferous age. A slight cloak of drift averaging about four feet in thickness overlies this rock, and in this drift large fragments of the sandstone lie embedded. As this drift is mostly composed of sand and gravel below the surface soil, it would seem to indicate that the action of water must have produced the intermingling of such surface blocks of the stone as had from any cause been broken up, with the glacial deposits in which they now lie embedded.

To what depth this stone extends is not known, as the quarrymen have yet penetrated only to the depth of eight feet, but from the fact that the limestone is reached on every side within a quarter of a mile, at a depth of only four or five feet, it would seem to be certain that the greatest depth of this sandstone cannot exceed twenty feet, and the probable depth is not nearly so great as that. Indeed it is quite possible that the entire deposit is a mass transported here bodily by the ice.

ARCHÆOLOGY.

The mound-builders, who left their traces in almost every county in Indiana, have given us proofs of their presence at many points in White County. In the vicinity of West Bedford, in Monon Township, there are a number of mounds. They are generally small, and appear to have been either sacrificial or memorial, rather than fortifications or places of refuge. Some of these mounds have been opened, and skeletons, stone hatchets and arrow and spear heads have rewarded the explorers. These mounds are generally circular in form, of a diameter ranging from twenty-five to seventy-five feet, and from two feet to ten feet in height. Large trees, varying in diameter from two to four feet grow upon some of the mounds testifying to their antiquity; and whether the builders were the ancestors of the red Indians of later times, or of a different race and lineage, no question can exist that these tumuli were reared at a very remote period of time.

NATURAL HISTORY.

The natural history notes of this county will be found in another paper, and when the ground shall have been fully worked over the report can not fail to have a deep scientific interest. The whole of the Kankakee and Tippecanoe regions will be found surprisingly rich in material both

botanical and zoölogical. The ridge or water-shed between the two streams appears to be a meeting place for contending floras, and the waters and wet lands are infested during the spring and autumn migrations with a great variety of alien birds. The fishes and reptiles of the Kankakee and its tributaries have yet to be properly studied and reported. They promise to yield a most interesting return. The means at my command forbade any extensive examinations, and besides my duties for the time lay in the field of geological exploration with natural gas for the objective point, consequently but small attention has as yet been given to the fauna of these waters.

PULASKI COUNTY.

Although the act creating the County of Pulaski was approved February 7, 1835, its organization as a county was only effected by force of the act of February 18, 1839. It is thus shown to be one of the newest counties in the State. Despite many natural disadvantages, which are, however, of a temporary character only, this young county is rapidly developing into a rich, healthful and prosperous division of the State, the home of a contented and intelligent people, who are well aware of the agricultural possibilities hidden in their heavy humid prairie soil and requiring only the ditcher's hand to create fields second to none in fertility. While other older and dryer sections of the State have made wonderful advances in wealth and population, no fair comparison can be drawn between such sections and the heavier level and wet lands of the northwestern portion of the State; and though Pulaski County is yet behind many counties in both public and private improvements, few counties, if any, may justly claim a more rapid and solid progress in material wealth. For it must not be overlooked in any fair comparison that nature, though lavishly endowing her with a fertile and enduring soil, did much to bar her early march to settlement. The county is a great plain, largely prairie, and though traversed by the Tippecanoe River and the Monon Creek from north to south, the one crossing the county through the eastern tier of townships and the other through the western tier, yet the fall of the surface of the ground toward those streams is so slight, and the surface conditions are such that a vast expenditure of money in drainage has been required to render tillage possible.

The great advantages held by other sections of the State over this region in the start of the great race to settlement and civilization may be understood when it is recorded that in the year 1839, only forty-nine years ago, in this whole county, containing four hundred and thirty-two square miles, but thirty-four legal voters could be found.

Yet such has been the change wrought by the energy and intelligence of the settlers that in the year 1888 no less than three thousand votes will

be polled at the presidential election. The advance in wealth, education and intelligence has kept pace with the increase of population, and having now barely reached that stage of development when it becomes possible to add the beauties of culture and ornament to the great framework of material prosperity; with a soil of great fertility, an industrious and contented population, and with a position and climate equal to any in the State, it requires no gift of prescience to foretell the steady progress of Pulaski County. The general surface of the ground in this county is quite flat, a plain slightly inclined to the south, with excellent lateral drainage for the eastern half of the county into the Tippecanoe River, and for the western half into the Monon Creek. Like most of the level, wet regions of the State, this county lies very high, the surface water shedding from its borders in almost every direction.

North of the county, within ten miles, the Kankakee River runs westward to the Illinois line, and several small streams and ditches flow from the north line of the county into English Lake and the lower Kankakee.

The Tippecanoe and Monon flow south through the county as before stated, and close to the west line of the county rises the Pictaminck River, which flows west into the Iroquois.

It is with great difficulty that the position and nature of the stratified rocks underlying the drift in this county can be determined.

There have been few deep bores made, and these tell an inconsistent and unsatisfactory story.

Enough is revealed, however, to show that the drift, which is more than two hundred feet deep along the eastern line of the county, thins out as we go west until the Niagara rocks are barely concealed at Monon, in White County, three miles south of the Pulaski County line, and on a line thence north to Francisville, in Pulaski County. Indeed, at Monon the shallow creek flows upon a floor of Niagara limestone, and the banks are of the same material. In the report of the survey of White County contained in this volume will be found a fuller account of the peculiar and interesting exposure of the Upper Silurian rocks at that place and the lesson to be drawn therefrom. The same Niagara limestone was found at Francesville at a depth of about a dozen feet immediately underlying the shallow cloak of drift. There can be little doubt but that the Silurian rocks have been upheaved along the line dividing Pulaski from Jasper County, but the extent of the upheaval and the direction of greatest energy can not yet be ascertained.

At the town of Winamac, situated fourteen miles in a northeasterly direction from Francisville, the bore made for the citizens' gas well discovered the Devonian shale below one hundred and ——— feet of bowlder drift, and the Devonian rocks were pierced to a depth of —— feet before the Niagara limestone was reached. Whether there is a gradual rise of the Silurian rocks from Winamac to Francisville, or whether the up-

heaval is more pronounced and confined to narrower limits along the western border of the county, can not yet be certainly known.

The Niagara rock is everywhere out-cropping, or barely concealed by the drift from a point in White Post Township, three miles north of Francisville, to a point three miles south of Monon in White County, and from a point two miles east of Francisville to Renssalaer in Jasper County on the west. The crown of the arch appears to be in a line running northwest and southeast through Monon, passing two miles west of Francisville toward the head-waters of the Pinkaminck River.

In this area all the strata of the sedimentary rocks are upheaved, at least all below, and including the Niagara limestone. Thin patches of Devonian limestone, and possibly small areas of Devonian slate may be found within the bounds given, and if so, these will be found in place, as they were deposited after the upheaval of the older strata. In Salem Township, two and one-half miles south-west of Francisville, a well was bored in 1867 to a depth of nine hundred and sixty (960) feet on what is known as the "Blair farm," which proved to be of the most interesting character. At a depth of nine feet the Niagara limestone was reached, and after passing through this to a depth of probably six-hundred and twenty feet, (though the neighborhood report says five hundred feet) a stratum of gas-bearing rock was found, and a strong flow of gas at once began. The boring was persisted in until the water was struck in the Trenton limestone and the bore was flooded, the water rising to a point far above the gas-bearing rock. The force of the gas lifted the water to the surface and a flowing well was the result. The outflow of water and gas was continuous for nine years, since which time it has been intermittent. The water is clear and not unpleasant to the taste though strongly sulphuretted. It has a neighborhood reputation of being very wholesome and having valuable medical properties. Doubtless its offensive smell has much to do with its supposed medical value. The gas flowing from this well was at once utilized by the farmer near whose residence the bore was made, in cooking feed for his stock and in lighting a large lamp, which was kept burning day and night, the gas being conveyed to the lamp by an iron pipe. The big, bright flame served as a well known beacon for the neighbors in crossing the prairie for many years.

This well was never cased, and of course a process of drowning has been going on for twenty years, and the water has so far destroyed the outflow of gas that the artesian character of the well has ceased, and only a bubbling of the surface water betrays the presence of the escaping gas. Since the discovery of natural gas in Ohio and northeastern Indiana attention has been drawn to this old find of gas, and Mr. Bucklin, of Chicago, has purchased the old "Blair farm," and is thoroughly testing the field. The first bore was made at a point within three hundred feet of the old well, and after going through six feet of drift and six hundred

and twenty feet of rock a strong flow of gas was found, and the boring was not further persisted in. The pressure of the gas at once reached two hundred and fifty pounds to the square inch, and this pressure has since been steadily maintained. The quality is excellent, a light, clear and almost odorless gas, burning with a fine, clear flame with very little smoke, while the heating qualities are good, as well attested in the furnaces of the engine which is being used to drill the wells now being bored. With no lack of means at his command, and with enterprise and liberality equal to any occasion, it is safe to say that Mr. Bucklin will fully develop this new gas field, and determine the question as to whether the reservoir is a local and limited one, or whether, contrary to all previous discovery in this State, an enduring supply of natural gas shall be secured stored in the strata above the Trenton rocks. Many questions of great interest to the geologist will call for investigation and settlement if this flow of gas shall prove to be permanent, as it now promises to be.

It will be interesting to discover whether the stratum of porous limestone here found at the base of the Niagara deposit is the original storehouse of the gas, or whether the Trenton limestone, rent and fissured by an old upheaval has yielded its garnered gas to the higher stratum. It may yet be found that the supply of gas stored in this stratum of rock is limited, and will fail after a short use, and in favor of this theory it may be said that the deep bores at Francisville, reaching and deeply penetrating the Trenton rock, found no gas; that one of the wells drilled by Mr. Bucklin on the "Blair farm" only about five hundred (500) feet north of the well "number one," which yields a good flow of gas, was drilled into the Trenton rock until flooded with "Blue-lick" water and yet emitted no gas; and that wells bored to the north, at Medaryville, to the south at Monon, and at other proximate points have yielded no gas.

The shattered condition of the Niagara limestone, which is the surface rock in the region of these wells, indicates that in this locality the ancient upheaval was of a very violent character, and accompanied with much concussion, for the stone is not simply broken, but split and shattered in the most extraordinary manner. The surface rocks at Monon dip in many directions and are crushed together in places in the most confused and chaotic way. That this shattered condition of the Niagara limestone is not superficial, but extends to the lowest stratum, is proved by the action of the drill in every bore yet made at this point. The gentlemen engaged in boring the wells at Francisville, as well as at Monon, make the uniform complaint that the drill in its descent finds cracks in the limestone with such an inclination as to deflect the drill from its course and thus render the boring extremely difficult, and in several instances the crevice was so great that the bit was lost. A few miles northwest of Francisville Mr. J. H. Prewitt, with the assistance of other gentlemen, cleared the earth from about a natural spring to the depth of eight feet, laying bare the Niagara

limestone. It was found that the clear cold water rose in great volume from a long crevice in the rock. This crevice has a width of about ten inches, slightly inclined to the southwest, and is evidently of great depth. A long pole thrust down finds no bottom, and the character of the water indicates its subterrane reservoir.

Arrangements have been made by the enterprising citizens of Francisville with Mr. Bucklin, to pipe a supply of gas to that town, and before this report is in type the sooty coal and cumbrous cord-wood which has heretofore served the citizens for fuel will have yielded place to the lighter, cleaner and less troublesome gas. Mr. Bucklin has two wells now flowing about equal quantities of gas, and other bores will be drilled in as rapidly as possible. The work is being done by Mr. Jack Robinson, who has had large experience, having drilled some of the earliest gas wells found in Pennsylvania, and later in the Lima, Ohio, field, and in Eastern Indiana sunk a large number of successful wells. He has great confidence in this new field being developed, that it will prove a permanent as well as plentiful supply of fuel for the neighboring towns to which it may be piped, and that no fears need be entertained as to its exhaustion.

Should this field prove to be as valuable as now indicated, much will be added to the wealth of Pulaski County, and the gas having been piped to the town of Monon, in White County, a distance of only five miles, there can be little doubt that the shops of the Louisville, New Albany & Chicago Railway will be attracted to that place, and the result will necessarily be a rapid and material advancement in wealth and prosperity.

Before the drilling of the wells on the "Blair farm," by Mr. Bucklin, the citizens of Francisville bored two wells in the town, in each of which the Trenton limestone was reached at about nine hundred and five feet. The Niagara limestone was, as usual in this vicinity, found to be the surface rock, and was with the greatest difficulty penetrated on account of the shattered condition of the rock, the oblique fractures leading the drill estray. At a depth of about six hundred and twenty feet the Niagara limestone having been passed through, a porous limestone was entered and a flow of excellent lubricating oil was struck. This yielded at the rate of five to ten barrels per day, and the boring should have been arrested at this point, but the citizens, contrary to the advice of Mr. Robinson who was sinking the well for them, insisted on tapping the Trenton limestone, and this was done. No oil or gas was found in that rock, and the boring continued until the water flooded the well and the oil was drowned.

Traces of bog iron ore are discoverable in many places in this county, but there are no deposits of sufficient importance to merit the attention of manufacturers. There are no valuable mineral deposits yet disclosed anywhere in the county. Should the natural gas prove persistent and plentiful we may expect a considerable advance in the material prosperity

of the towns within reach of the newly discovered field. The work of the ditcher will, however, do more for the future prosperity of Pulaski County than any development of the possible stores of oil and gas hidden in her rocks. Much has already been done in this direction in the construction of large open ditches, but the net-work of under drains required to render the soil thoroughly cultivatable, is only fairly begun. Enough has been done to greatly improve the sanitary condition of the county, as well as to lay the foundation of effective husbandry, and nowhere is the immediate effect more apparent than in these heavy soils.

There are few historical notes of great interest connected with this county. All that region of country comprised within lines drawn from Detroit, Michigan, to the southern point of Lake Michigan, thence to the mouth of the Wabash River, thence to the mouth of the Scioto River, thence to Detroit, was once the dominion of the Twigtwees or Miami Indians. As early as 1672 the French missionaries and traders found them in possession of this domain, and they held it against all intruders until the advent of the all-conquering race. The region adjacent to the north bend of the Tippecanoe river was the last place abandoned by these Indians, and it was only in the year 1832, by a treaty signed by Wah-she-o-nos, Wah-ban-she, Aub-bee-naub-bee, and other chiefs on the 26th day of October, that what is now Pulaski County was ceded to the United States. Even after this treaty the Indians did not all leave for their new homes west of the Mississippi River until the year 1842.

Neither these Indians nor the earlier mound-builders have left many marks of their long occupancy of the country.

In Indian Creek Township, at a point opposite Pulaski Mills, in the "bottom" or alluvium of the Tippecanoe River, is a large mound about one hundred feet in diameter at the base, and which was, before being plowed over, fully twelve feet high. Many years ago an excavation was made in this mound by a minister then sojourning in the neighborhood, with the result of unearthing several crumbling human skeletons. The bones were reported to have been very large and strong, but soon yielded to the action of the air and crumbled to dust.

At two points in the river valley south of Pulaski mills other smaller mounds are found. These have been opened, the result being a few crumbling bones mixed with charcoal. No implements were found, though many arrow and spear heads, stone axes, and similar weapons of war and the chase have been picked up in different parts of the county, notably in the alluvial valley of the Tippecanoe River.

THE TIPPECANOE RIVER.

This stream is a natural feature of the landscape of several counties of such exceeding beauty and value as to deserve a separate paper devoted to it exclusively, but the limits of this report deny it, and attention can only be called to that portion of the stream within and near the borders of the counties of Pulaski and White. With an average width of one hundred feet, the beautiful river enters Pulaski County from the east at a point about half way between the village of Marshland, on the Vandalia Railway in Fulton County, and the town of Monterey, in Pulaski County. For five miles from thence in a northwesterly direction it flows through the northeast corner of Pulaski County, crossing the north line of the county into Starke County, where at a point called "North Bend," at the farm house of Mr. J. Stryker, it boldly turns to the south under a high bank, and thereafter maintains a generally southerly course until it empties into the Wabash near Lafayette.

I have called it a "beautiful" stream, but neither that word nor any other is strong enough to properly characterize its exceeding loveliness.

There are many fine streams in the State of Indiana, but not one that can be compared with this river. Its rare beauty, its splendid fishing, the good shooting to be found along its banks, the numberless cold springs that bubble out of the high bluffs, the small green islands that are met at almost every turn of the stream, the clear water flowing over the assorted sand and bowlders of the northern drift, or the masses of heavy green grass attached to the bottom and waving in the moving water like a tiny forest in a "broad and equal blowing wind," lend a charm against which few hearts are proof. In order to fully explore this fine river I launched a small canvas boat at Marshland, in Fulton County, and floated down the stream a distance of fifty miles to Monticello, in White County. Such a trip, without any companion, would, under ordinary circumstances, prove to be a very lonely one, but such is the varying beauty and interesting character of the rapidly flowing river that no journey ever proved more pleasant. From Marshland to a point south of Pulaski Mills, in the southern part of Pulaski County, the river flows in a bed of bowlder clay, at no point cutting through the drift, but at a point two miles north of the line of White County the channel of the stream is cut down to the Devonian shale, and from thence down the stream to its confluence with the Wabash the strata of the Devonian rocks outcrop at many points, notably near Norway Mills, in White County, and at a bluff south of Monticello.

At the time of my voyage the stage of water in the river was extremely low, and every characteristic of the river bed was easily discoverable. Flowing, as it does throughout most of its course, in a channel hollowed in the bowlder drift, the stream is a succession of pools and shallows,

neither of great extent, and alternating with such ever varying form and character as to form a source of pleasure always enhanced by the element of surprise. By the sorting process of the water the large bowlders have been selected from the drift and, by reason of their greater weight, deposited in the bed of the stream. In times of flood the increased power of the water has pushed them along until some point of obstruction has been reached, where a vast accumulation has taken place, and these, damming the water above, form a long and deep pool.

The water from the pool over-lipping the dam and struggling through the long tangle of bowlders below forms a ripple, shallow and swift, in which the fish find favorite nesting grounds.

There is no mill nor any artificial obstruction of the stream from the crossing of the Vandalia Railway at Marshland to the town of Winnamac, a distance of nearly thirty-five miles following the sinuosities of the river, and nowhere in the State is there such a reach of running water so well stocked with fine fish. It is not only as an angler's paradise, however, that this river has precedence of our many streams, but the sportsman who loves the gun better than the rod will find the banks of the Tippecanoe the best game preserves yet remaining in the State. The prairies which are skirted by the river in Pulaski County are yet favorite feeding grounds of the pinnated grouse, and the best wood-cock cripples to be found in the Mississippi Valley, borders Mill Creek near its junction with the Tippecanoe three miles South of Winnamac. Not only at this one point, but everywhere along the river in damp bottoms, in springy places under bluffs, and wherever secluded feeding grounds appear, the wood cock may be found.

Formerly the waterfowl in great abundance visited the stream in the spring and fall of the year, but now the flights are irregular and the numbers annually decrease.

The small-mouthed bass (*Micropteros Dolinuiu*) is the principal game fish inhabiting these clear waters, though the large-mouthed bass (*Micropterous Salmoides*) may occasionally be found, and the pike or pickerel, which formerly reigned in undisputed mastery, both because of its prowess and numerical superiority, may yet be found, though in greatly lessened numbers. Though the angler may lament the steadily decreasing numbers of the pike while remembering his game qualities, yet the loss by the extinction of this voracious fish will be more than compensated by the gain in other game varieties, for the pike is the remorseless and insatiable enemy of all the other game fish, and will not hesitate to make a meal off his own kind.

A few years ago the use of seines and dynamite threatened to render the Tippecanoe River as barren of game fish as the same shameless violations of the law have left many of our other streams, but better views seem now to obtain, and the seining has ceased, and only an occasional

instance of the use of explosives and of fish poisoning occur. The value of the river to the people of the State as a preserve of the most valuable game fish can scarcely be over-estimated, for if nowhere else in the State may we look for such a supply of the dainty food yielded by *Micropteros Dolinuiu*. That something is gained by preserving the game fish in our rivers for the mere pleasure of angling, does not admit of a doubt, but when a valuable source of food supply is added to the delights of the rod and reel, the economist should make common cause with the sportsman in the work of protection. The statutes which have been framed to guard our streams against the seine, poison and dynamite, are sufficiently stringent, but as detection of offenders is not easy because their depredations with the seine are generally at night, and with dynamite in secluded places, and as no inducement is given to informers, the criminals go unpunished. The law should be so amended as to increase the penalty in case of conviction and one half the penalty should go to the informer. In such case the detection of the ravages would be certainly accomplished, and the game fish given the same opportunity to breed and increase which we allow to the ruffed and pinnated grouse of our woods and prairies. When this is done the angler may seek the deep pools of the Tippecanoe River at any time with full confidence in a good day's sport with the result of a well-filled creel

The geological notes collected while exploring this stream are included mostly in the report upon White County and in the paper upon the Wabash arch. There are fine outcroppings of stratified rock, mostly Devonian shales and limestone (Corniferous), at points from a little above Monticello to near Lafayette. These outcroppings show the deposits above the Niagara in place, while the latter, and all inferior deposits, are greatly disturbed. Indeed, the channel of the stream has been controled for a considerable part of its length by a great break in the stratified rocks, as is also the case with the Wabash River. Where the Devonian formation is the surface rock we find that the glacial plow has laid the furrow for the stream, and this is no doubt true to a degree where the Niagara comes up; but the larger fact remains that a peculiar broken and creviced condition of the Upper Silurian strata has greatly affected the course of the stream wherever the Devonian has been displaced by erosion.

The bottom lands of the Tippecanoe River are justly famed for their extreme fertility. The soil is a warm, sandy alluvium, rich in vegetable matter, easily cultivated and wonderfully productive. Some extensive and flourishing mills are situated on this river near and below Monticello. The power furnished is ample, and comparatively inexpensive.

The farther southward and westward we follow the course of the river, higher and bolder become its bluffs and the deeper sinks the channel. In many places fine sections of the drift have been made by the cutting of

the stream. Usually, however, bluff alternates with bottom, so that on one side of the river the banks may be high and precipitously steep, while on the other lies a wide, low stretch of fine alluvial farmland.

In some places the timber, which consists of oak, hickory, walnut, maple, ash, plane and poplar (tulip—*liriodendron tulipifera*) is very heavy, but in the main it is scattering and has been greatly reduced by indiscriminate cutting.

Upon the whole, the valley of the Tippecanoe is a well drained, fertile, healthful, highly cultivated region, owned and held by a happy, intelligent and very prosperous people.